
RECLAMATION
Managing Water in the West
Proving Federal Feasibility
Stakeholder Workshop 2019
Denver, Colorado

RECLAMATION
Managing Water in the West

Proving Federal Feasibility: The Reclamation Planning Process

Bill Taylor, Ph.D. Reclamation Law Administration Division Acting Manager

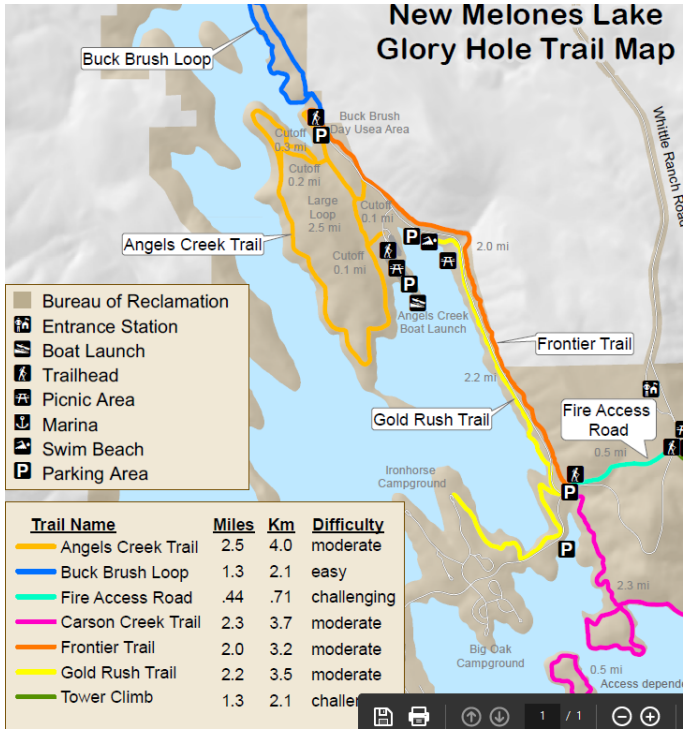
Policy and Administration

What is planning and why do we do it?

- Planning is the process used to establish a recommended (feasible) Federal investment.
- Planning helps decisionmakers evaluate infrastructure solutions to various problems.

What defines Federal water resource planning?

- Must provide net public benefits.
- Oriented around feasibility reports, which must be authorized by Congress
- Studies must be cost-shared by non-Federal partner
- Feasibility Study results in a Feasibility Report



What is Congress' Role

- Congress must authorize Feasibility Studies.
- Resulting Feasibility Report is the basis for recommending project authorization.
- Authorization and appropriations required for construction.
- WIIN Act contains limited study authority.

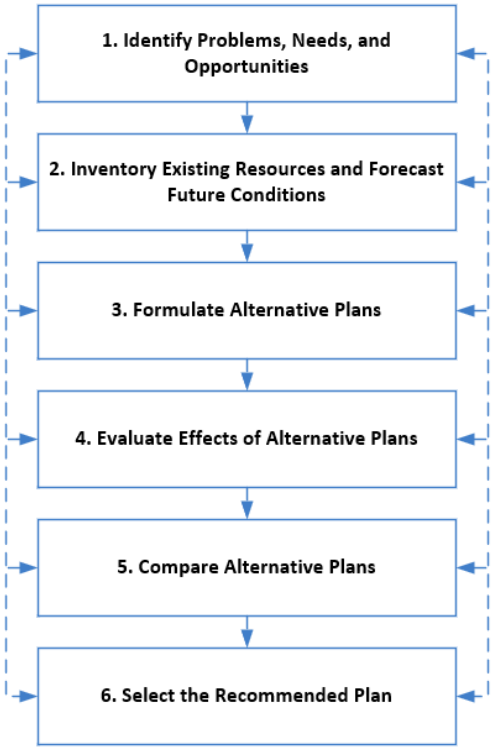
What are the Four ‘Pillars’ evaluated in a Feasibility Study

1. Environmental Feasibility
2. Financial Feasibility
3. Economic Feasibility
4. Technical Feasibility

What documents guide creation of a Feasibility Study

- Statutory authorization
- Principles, Requirements and Guidelines (2013)
- Department of the Interior Manual 701 DM 1 (ASP)
- Reclamation Manual CMP 09-02

What is happening in a Feasibility Study?



- Evaluating alternative plans
- Evaluating non-structural alternatives
- Often, more than one alternative meets the objective(s).

What is evaluated in a Feasibility Study?

- Future with and without project
- Environmental and financial conditions
- Economic effects
- Engineering/technical considerations
- Each alternative's acceptability, efficiency, effectiveness and completeness

Who gets selected in Feasibility Report

- Generally select the plan that maximizes net public benefits
- National Economic Development (NED) alternative
- The Locally Preferred Plan can be selected as long as it provides net public benefits

The Four ‘Pillars’

The Four ‘Pillars’: Technical Feasibility

Technical Feasibility: considers hydrology, hydraulics, civil, mechanical, geotechnical, electrical, operational, surveying, cost estimates and other.

More soon…

The Four ‘Pillars’: Economic Feasibility

Economic Feasibility: Considers period of analysis, Federal discount rate, National Economic Development (NED) benefits, monetized and non-monetized, quantified and non-quantified, and willingness to pay.

More soon…

The Four ‘Pillars’: Environmental Feasibilty

- NEPA/Environmental Impact Statement
- State-based environmental compliance
- Endangered Species Act
- Fish & Wildlife Coordination Act

The Four ‘Pillars’: Financial Feasibility

- Can the users afford it?


Questions?
Bill Taylor, Ph.D.
wtaylor@usbr.gov
RECLAMATION
Managing Water in the West

RECLAMATION
Managing Water in the West

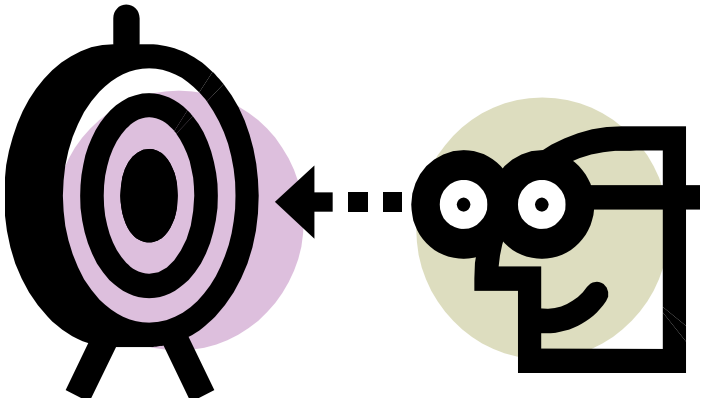
Proving Federal Feasibility: Cost Estimating

Kristi Evans, PE, DEC Program Manager

DEC/VP Office

Agenda

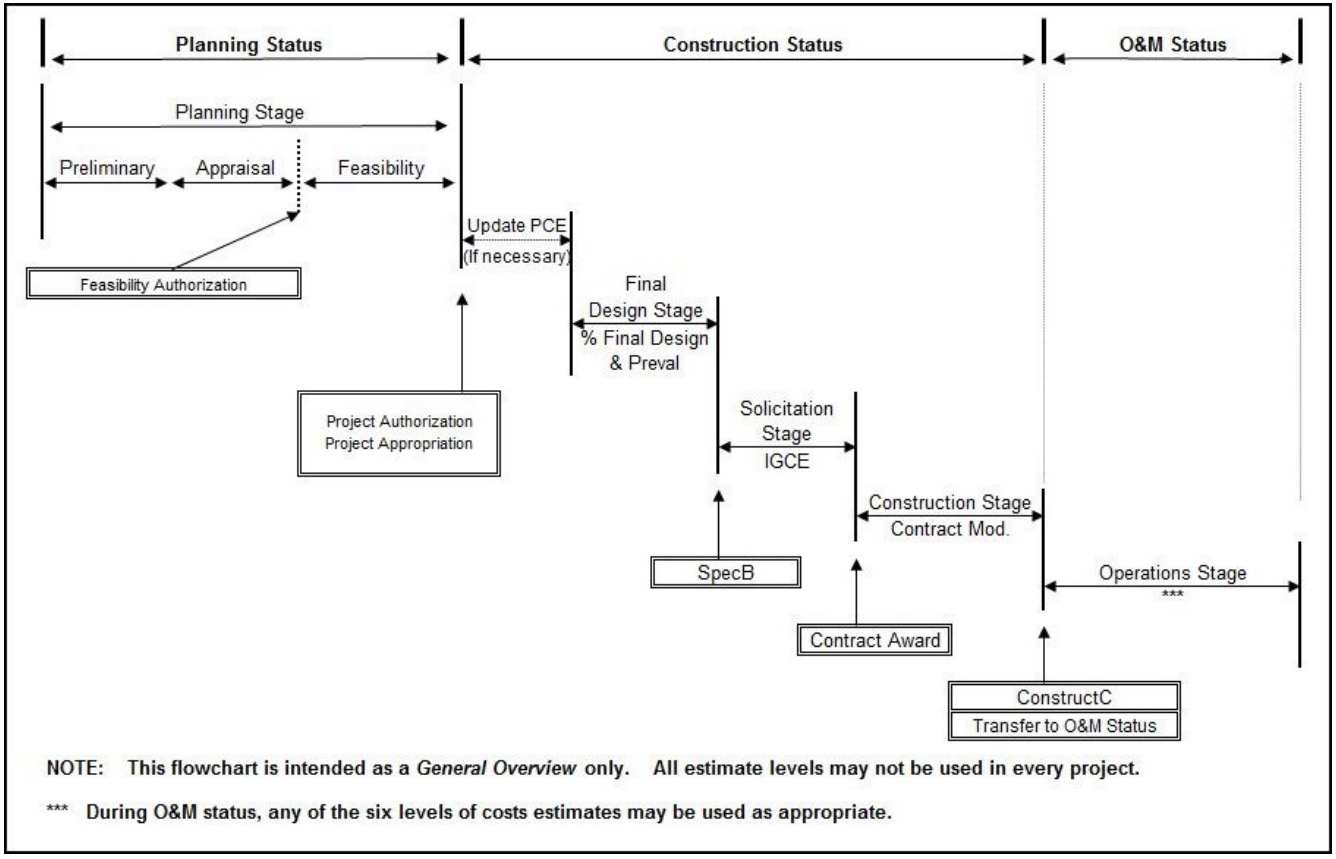
- Policy/Directive & Standards (D&S)
- Project Flowchart – General Overview
- Levels of Cost Estimates
- Allowances and Costs



Policy/Directive & Standards (D&S)

- Cost Estimating Policy
  - FAC P09 – Cost Estimating
- Cost Estimating Directive & Standards (D&S)
  - FAC 09-01 – Cost Estimating
  - FAC 09-02 – Construction Cost Estimates and Project Cost Estimates (includes Cost Classification)
  - FAC 09-03 – Representation and Referencing of Cost Estimates in Bureau of Reclamation Documents Used for Planning, Design and Construction
- Policy and D&S can be found at https://www.usbr.gov/recman/

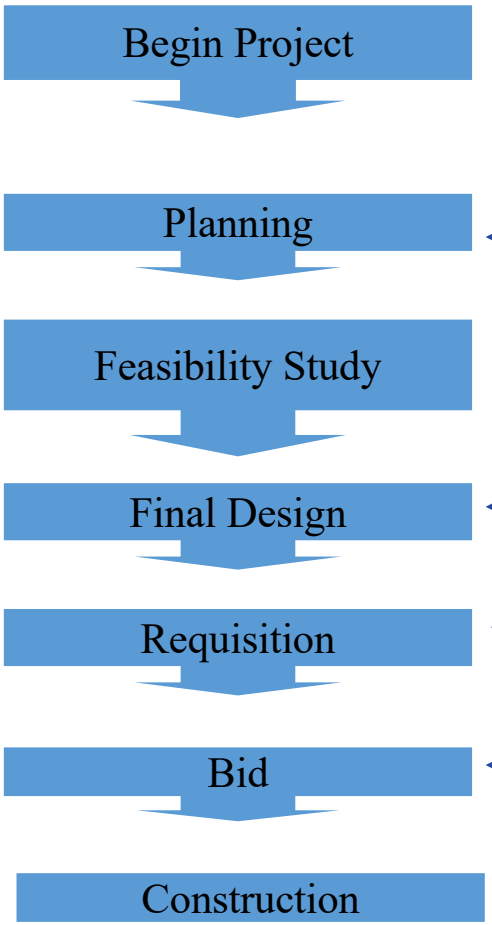
Project Flowchart – General Overview



Levels of Cost Estimates

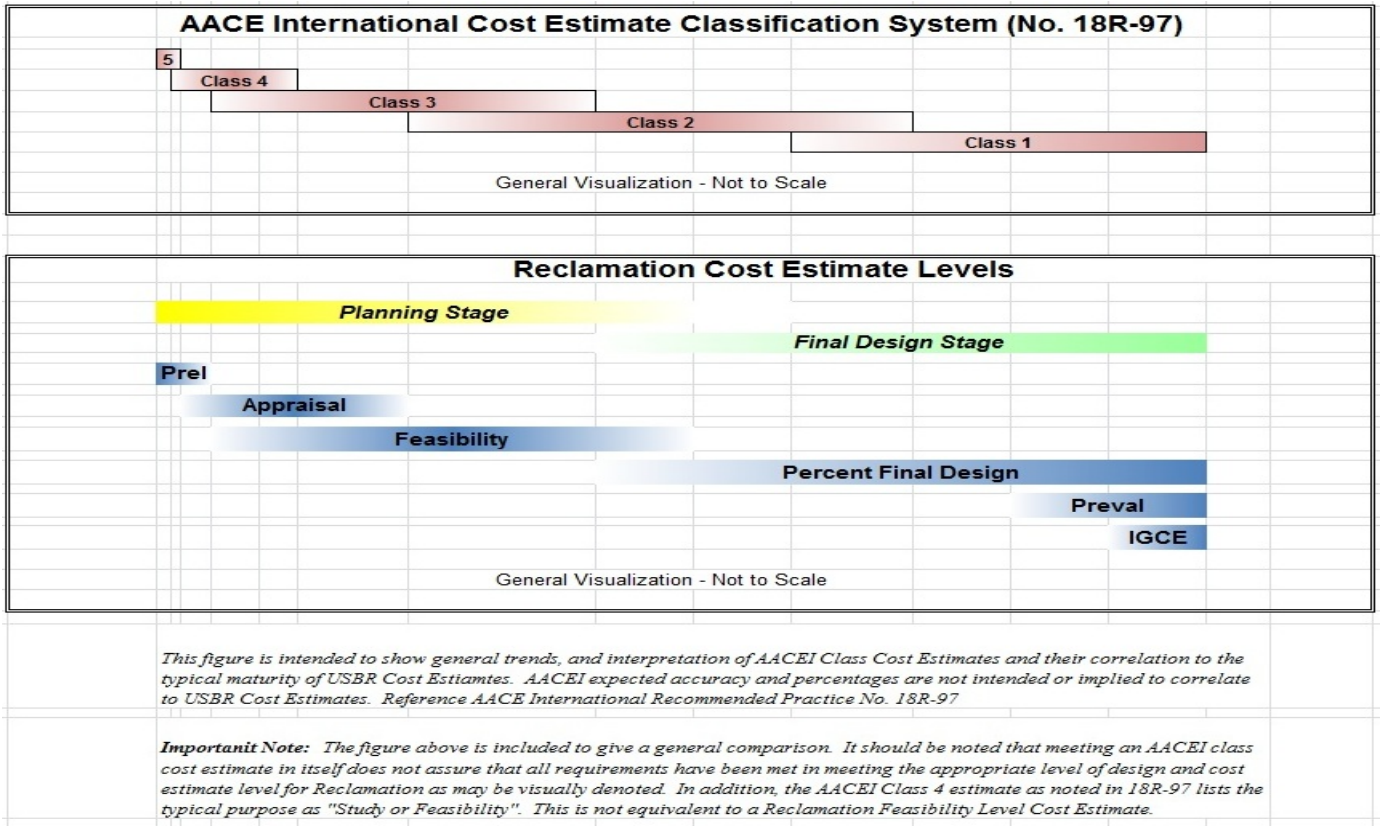
- Planning
  - Preliminary Cost Estimate
  - Appraisal Cost Estimate
  - Feasibility Cost Estimate
- Final Design
  - Percent (%) “Final” Design Cost Estimate
  - Preval (Prevalidation of Funds Estimate/Funding Estimate)
  - IGCE (Independent Government Cost Estimate/Engineer’s Estimate/Bid Estimate)

The Life of a Cost Estimate



- **Preliminary (Planning) Level Cost Estimate**
  - Typically prepared for studies at the early stages of the planning process
  - See Appraisal for similar bulleted descriptions but note that both types of Contingencies % could be higher than typically used for Appraisal Level
  - Order of Magnitude estimate
- **Appraisal (Planning) Level Cost Estimate**
  - Typically Prepared for Appraisal Study [multiple alternatives]
  - Limited Information and Quantification, limited design data
  - Should not be used for Congressional Authorization
  - Typically - Design Contingencies @ 15%; Construction Contingencies @ 25%
- **Feasibility (Planning) Level Cost Estimate**
  - Typically Prepared for Feasibility Study [preferred alternative(s)]
  - Generally more thorough design data collected and evaluated
  - Initial Design, Draft Drawings, Quantity Takeoffs, List of Items
  - Used to develop the CCE used for Congressional Authorization
  - Typically - Design Contingencies @10% (Range @ 2 - 20%); Construction Contingencies @ 20%
- **Percent % Design (Final Design) Level Cost Estimate**
- **Prevalidation (Final Design) Level Cost Estimate**
- **IGCE (Bid Estimate/Engineer's Estimate)**

Reclamation vs AACEI Crosswalk



This figure is intended to show general trends, and interpretation of AACEI Class Cost Estimates and their correlation to the typical maturity of USBR Cost Estiamtes. AACEI expected accuracy and percentages are not intended or implied to correlate to USBR Cost Estimates. Reference AACE International Recommended Practice No. 18R-97

Importanit Note: *The figure above is included to give a general comparison. It should be noted that meeting an AACEI class cost estimate in itself does not assure that all requirements have been met in meeting the appropriate level of design and cost estimate level for Reclamation as may be visually denoted. In addition, the AACEI Class 4 estimate as noted in 18R-97 lists the typical purpose as "Study or Feasibility". This is not equivalent to a Reclamation Feasibility Level Cost Estimate.*

Cost Estimate Allowances and Costs

(For Planning and % Final Design Level Cost Estimates)

- **Cost Estimate Allowances (or Adders)**
  - Design Contingencies
  - Allowance for Procurement Strategy (APS)
  - Special Taxes (e.g. TERO, Gross Receipts, etc.)
  - Construction Contingencies
  - (Adder as needed) Escalation – During Construction
  - (Adder as needed) Escalation – Notice to Proceed (NTP)

- **Types of Costs**
  - Contract Cost
  - Field Cost
  - Non-Contract Costs
  - Feature Construction Cost

Cost Estimate Example

Item	Description	Qty	Unit	Unit Price	Amount
1	Mobilization and Prep Work	1	IS	$30,000.00	$30,000.00
2	Excavation for Pipe Trench	4,000	yd3	$10.00	$40,000.00
3	Furnish and Install Pipe	5,000	lin ft	$100.00	$500,000.00
4	Backfill and Compact Pipe Trench	3,000	yd3	$20.00	$60,000.00
	Subtotal w/Mobilization				$630,000.00
	Allowances: Design Contingencies (@15% + APS @ 3% = 18% (+/-)				$120,000.00
	Special Taxes: TERO @ 4% (+/-)				$30,000.00
	Contract Cost				$780,000.00
	Construction Contingencies @ 25% (+/-)				$190,000.00
	Field Cost				$970,000.00
	Non-Contract Cost @ 35% (+/-)				$330,000.00
	Construction Cost				$1,300,000.00
	Escalation to NTP @ 3%/year for 3 years				$100,000.00
	Construction Cost (w/Escl to NTP)				$1,400,000.00

Design Contingencies

- "Old terminology" (< 2007) = Unlisted Items to incorporate additional design considerations
- Is an allowance to capture uncertainties and minor items between planning and final design
- There are 3 considerations for Design Contingencies:
  - "Minor" Unlisted Items
  - "Minor" Design and Scope Changes
  - "Minor" Cost Estimate Refinements

  (Meant to be "small piece of the pizza)

Construction Contingencies

- **"Old terminology" (< 2007) = "Contingencies"**
- **Construction Contingencies are funds added to the Budget and Cost Estimate *to cover costs incurred after Award* and represent the total anticipated Field Cost**
- **An allowance for *overruns on quantities, changed site conditions, change orders, etc.***
- **Covers typical *uncertainties encountered after Award***

Changed Site Condition

Non-Contract Costs

May include some or all of the following:

- **Lands and Land Rights (project wide)**
- **Relocation of Property by Others (project wide)**
- **Distributive Costs**
  - **Planning (including Geotechnical Investigations)**
  - **Design Data Collection**
  - **PM, Design, and Construction Engineering/Management**
  - **Environmental and Cultural (i.e. NEPA, etc.)**
  - **Other costs**

Example: Typical Non-Contract Costs Percentages* (not all inclusive)

- Design data → 8%
- Design → 8%
- Permitting and compliance → 5%
- Preconstruction → 2%
- Construction management → 10%
- Postconstruction → 2%

Total → 35% (Example only)

Note: The above are to be adjusted for specific conditions on each project (range ~ 20% - 40% (+/-);

*Percentages are for example only!

Escalation

- Escalation may be added to all cost components to cover anticipated inflation
- There are two types of escalation considered for cost estimates:
  - Escalation to Notice to Proceed
  - Escalation During Construction

RECLAMATION
Managing Water in the West

Proving Federal Feasibility: Estimating Process Review

Kristi Evans, PE, DEC Program Manager

DEC/VP Office

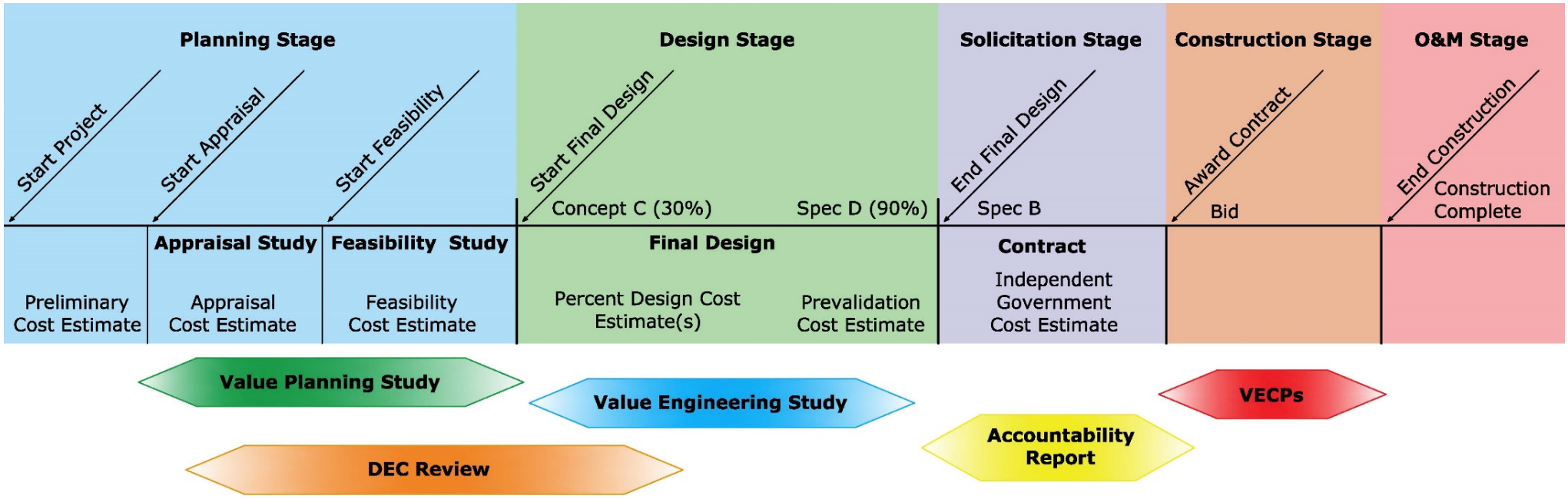
Proving Federal Feasibility: What we have heard

- "Reclamation gold-plates its construction designs."
- "Reclamation under-estimates benefits and overstates costs."
- "Reclamation would rather study forever than build anything."

Agenda

- Project Development
- Estimating Process Review
  - Purpose
  - Activities Summary
- Design, Estimating, & Construction (DEC) Oversight
  - Purpose
  - Feedback Summary
  - Comparison Review
- Questions – Please ask throughout the presentation

Project Development (Traditional: Design – Bid – Build)



VECPs – Value Engineering Change Proposals

Definitions

Appraisal Level - The level of analysis and data collection needed to initially determine the nature of water and related resource problems and needs in a particular area, formulate and assess preliminary alternatives, determine Reclamation interest, and recommend subsequent actions (CMP 09-02).

Feasibility Level - The level of analysis and data collection needed to prepare a recommendation to Congress regarding the implementation of a project or plan and, unless no action is recommended, the estimated total cost of implementation (CMP 09-02)

Estimating Process Review (EPR)

- **Mission: provide a forum to address Reclamation-wide Cost Estimating related priorities, issues, activities, and to facilitate cost estimating accomplishments**
- **Created to evaluate:**
  - **Perception of planning level (not final design) cost estimates possibly being conservative**
  - **Cost/Benefit Analyses potentially adversely affected**
  - **Perception that viable projects are not being authorized**
- **Working Group and Project Management Team (PMT) lead by DEC Oversight and includes Regional representation, Technical Service Center (TSC), and Policy Office**

EPR Activities (summary)

- Improving benefits estimates
- New trainings on cost estimating
- Benchmarking strategy
- Third party input
- Updating cost estimating in the Reclamation Manual
- Evaluate, scrutinize the discount rates used

Why do we perform DEC Reviews?

- Support successful project accomplishment by verifying major risk and uncertainties have been fully captured within the estimates
- Ensure high quality projects that serve its intended purpose
- Identification of findings/issues from a broad corporate perspective
- Validate technical documents reflect appropriate level of design and estimate (e.g. Feasibility Study includes feasibility level designs and estimates)

Congress set to investigate 'wasteful' GSA spending

April 03, 2012 | By Morgan Little

Which DEC Reviews?

- Summary based on 3rd Party consultant estimator's opinion.
- Four DEC Reviews completed with consultant estimator as a Team Member
- Started June 2017 through most recent November 2018
- Level of design and cost estimate: Appraisal to Feasibility to 30% Final Design
- Designs and cost estimates were prepared by Reclamation only, Reclamation and contractor, and contractor only. (Reclamation means Technical Service Center and/or the Regional/Area Office)

Feedback Summary

- Summary based on 3rd Party consultant estimator's opinion.
- Quality of the cost estimate related to Reclamation's Policy and Directives and Standards (Manual) as well as compared to industry practice:
  - Consultant estimator's opinion is that the cost estimates meet the quality as compared to the Reclamation Manual and industry standards. A few specific minor opinions were noted regarding possibility of missing or not included items.
- Accuracy and reasonableness of the cost estimate
  - Consultant estimator's opinion that the cost estimates were reasonable.
  - All cost estimates reviewed, per consultant estimator's opinion, appeared low but not in a significant way.

Comparison Review

- Black Canyon Powerplant Unit No. 3 Comparison Review
  - Overall, these two estimates seem very comparable. There were not any major findings during the review.

Estimator	Price Level	Schedule B Contract Cost
TSC (consultant price level)	Sep 2014	$49,227,500
Consultant	Sep 2014	$54,280,574
Delta	Sep 2014	($5,053,074), approx. 10%

  - Quantity takeoffs were done independently although the majority were within the same order of magnitude.
  - This review focused on the total price of cost driver line items.
- Reviews complete although summaries in-progress
  - Carter Lake and Pojoaque Basin Regional Water System (PBRWS)

Conclusion: What are we doing to improve estimates of benefits and costs?

- Improving documentation
- New trainings
- Benchmarking and third party input
- Improving our understanding of risk and uncertainty


Questions?
Kristi Evans, PE, DEC Program Manager
kdevans@usbr.gov
RECLAMATION
Managing Water in the West

RECLAMATION
Managing Water in the West

Proving Federal Feasibility: Economic Feasibility

Bill Taylor, Ph.D. Reclamation Law Administration Division Acting Manager

Policy and Administration

Economic Analysis

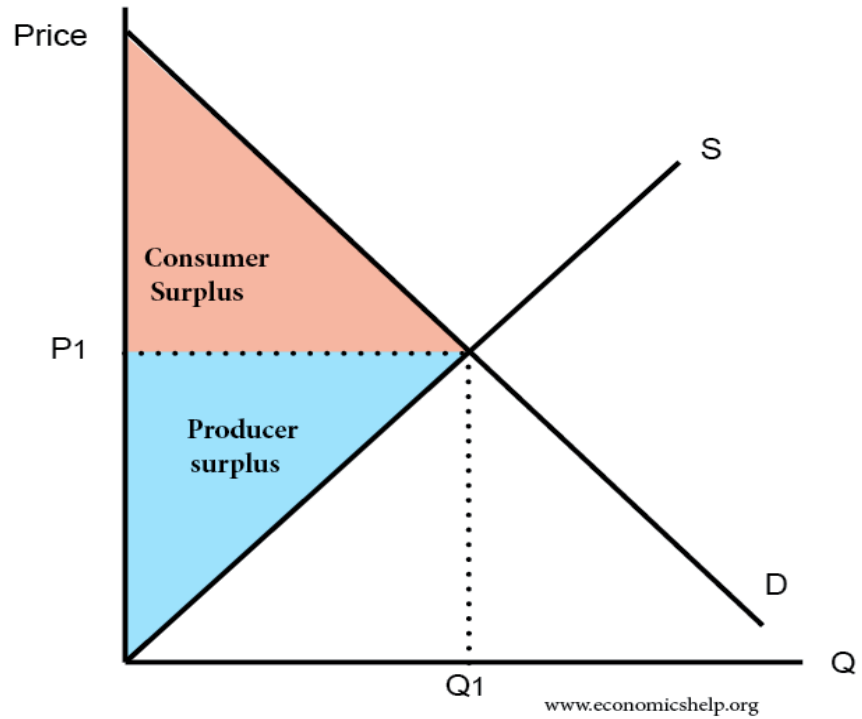
- Methods
  - Cost-benefit analysis
  - Cost effectiveness – incremental cost analysis
  - Regional impact analysis (IMPLAN)
- Period of Analysis: 100 years
- Federal Water Resources Discount Rate: 2.875% (FY 2019)

A Time of Change for Economics

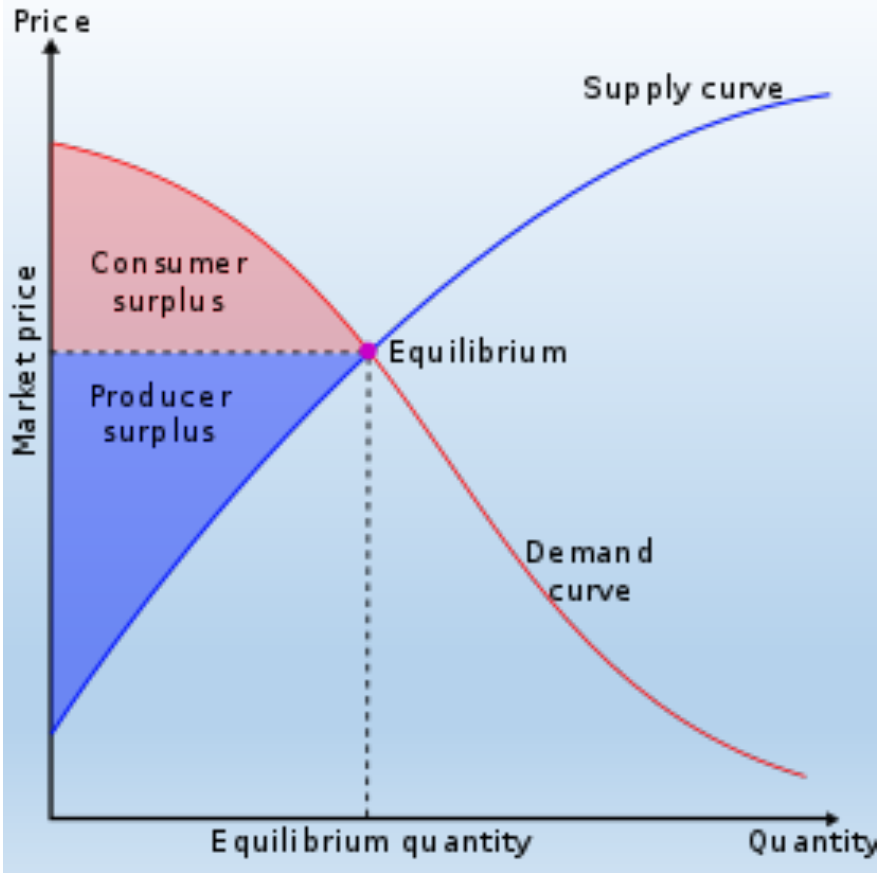
- Historically focus solely on:
  - Economic performance
    - Net economic gains
      - B/C comparison
- Principles, Requirements and Guidelines
  - Economic, environmental & social
    - Monetized and Quantified
    - AND NOW
    - Non-monetized & non-quantified

Economic Benefit Estimation

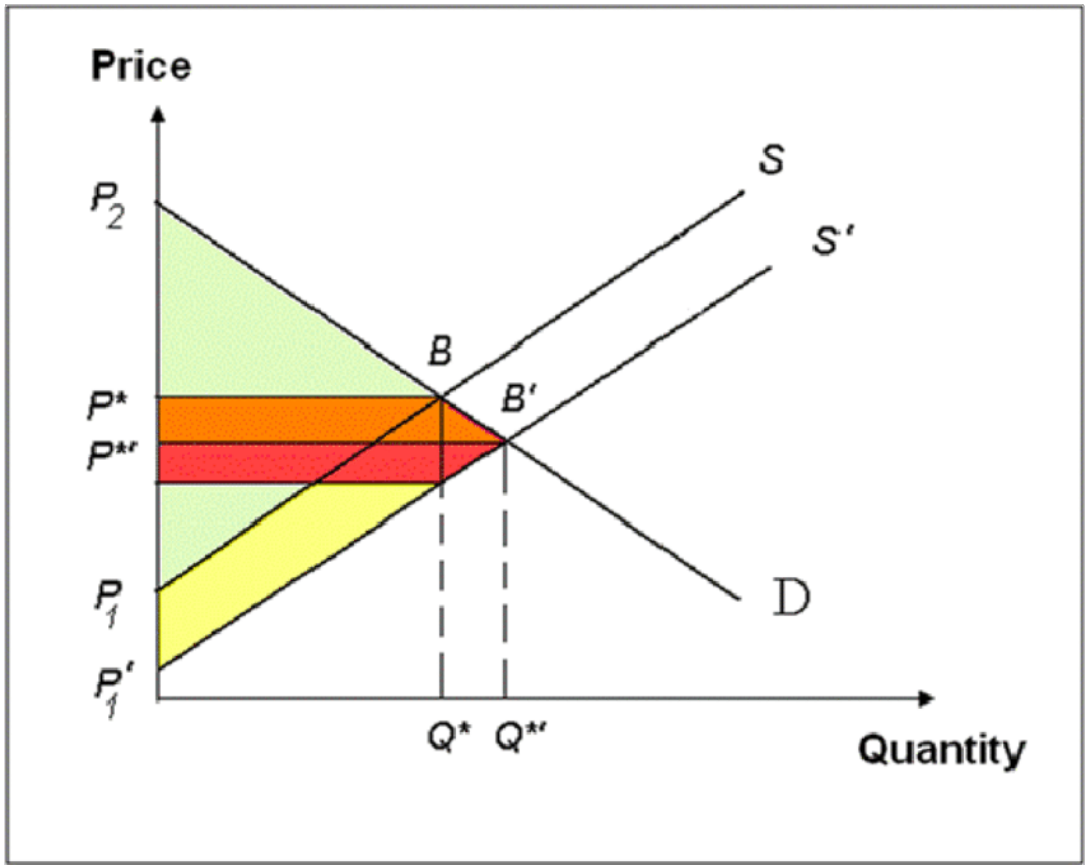
- **Objective is willingness to pay**



Economic Benefit Estimation



Economic Benefit Estimation



Economic Benefit Estimation

- In Reality use:
  - Market price
  - Stated preference
  - Change in net income
  - Cost of most likely alternative
  - Administratively established values

Frequently Observed Methods

- Changes in net income
  - Irrigation, flood damages
- Cost of Alternative
  - Power, Municipal and Industrial, Environmental
- Administrative Values/Stated Preference
  - Recreation

What are some persistent challenges in proving Federal Feasibility

- Valuing non-quantified and monetized benefits
- No single ‘approved’ method for non-quantified benefits
- Differing standards of feasibility (benefit/cost ratio vs ‘net Federal benefits’)


Questions?
Bill Taylor, Ph.D.
wtaylor@usbr.gov
RECLAMATION
Managing Water in the West

RECLAMATION
Managing Water in the West

Proving Federal Feasibility: Benefit Risk & Uncertainty

Bill Taylor, Ph.D., Reclamation Law Administration Division Acting Manager

Policy and Administration

What is the goal with respect to risk and uncertainty?

- To quantify uncertainty and variability
- To ascertain averages, mid-points, most likely outcomes or patterns in risk
- To aid selection of alternative

Analytical Process

- Monte Carlo analysis with literature and available data
- Evaluate irrigation, recreation, municipal and industrial, and environmental values
- Compare Reclamation benefit estimates at 3 study sites with Monte Carlo analysis results
- Initial results provide an indication of accuracy by benefit category

Monte Carlo Analysis

- Simulation is based on a PERT probability distribution of values and quantities that determine benefits
- The PERT distribution requires the user to define:
  - Minimum
  - Most Likely
  - Maximum values
- Used to examine cost estimates
- Monte Carlo results are only as good as the input data

Irrigation Gross Revenue Analysis and Benefit Impacts

- Applied Monte Carlo to price and yield data and compared to typical Reclamation approach
- Results
  - General application to Western United States Counties – consistent results
  - Nelson Dikes SOD – consistent results
  - Glendo/Guernsey SOD – slight overstatement
- Conclusion
  - Monte Carlo analysis indicates Reclamation approach does not systematically over or understate irrigation benefits

Recreation Benefit Analysis

- Applied Monte Carlo to recreation visitation and per visit value data and compared to typical Reclamation approach
- Results
  - General application to Western United States (database values)– No systematic over or under statement of benefits
  - Nelson Dikes SOD – potential overstatement of recreation benefits
  - Glendo/Guernsey SOD (historical visitation)– potential overstatement of non-fishing related benefits, slight understatement of fishing benefits
  - Los Angeles Basin Study (trail mile)– significant underestimate of benefits
- Conclusion
  - Potential understatement of benefits in an urban setting, no indication of a systematic over/under estimate in SOD studies

Water Supply Reliability Benefit Analysis

(Municipal and Industrial water shortage)

- **Applied Monte Carlo in typical Reclamation approach**
  - **Values based on study**
  - **Households served during shortage**
- **Results**
  - **Los Angeles Basin Study – potentially underestimate of M&I reliability benefits**
- **Conclusion**
  - **Understate benefits to a moderate degree**

Ecosystem Services Benefit Analysis

- Applied Monte Carlo in typical Reclamation approach
  - Benefit based on habitat acre from other studies
  - Open space acreage from project descriptions
- Results
  - Los Angeles Basin Study – best estimates potentially overstate benefits
- Conclusion
  - Average or best estimates will moderately overestimate

Risk and Uncertainty Conclusion

Reclamation methods in limited sample

- **Irrigation – fairly consistent**
- **Recreation – no systematic over/under estimate except in an urban setting where potentially understated**
- **Water supply reliability (M&I shortage) – moderate understatement of benefits**
- **Ecosystem – Potentially overstate benefits**

Provides direction for future examination


Questions?
Bill Taylor, Ph.D.
wtaylor@usbr.gov
RECLAMATION
Managing Water in the West

Conclusions: Proving Federal Feasibility

- Reclamation planning process is well defined historically, but continues to evolve
- New techniques and data are relevant, as in every field
- Reclamation taking steps to improve cost estimation and estimation of benefits


Any comments or suggestions?
RECLAMATION
Managing Water in the West